

PRE-CAMBRIAN -

The Pre-Cambrian rocks of Tasmania are restricted almost entirely to the western part of the island. They are most abundant in the south-western portion and form a belt with a north-south trend and having a length of 130 miles and a -- width ranging from 20 to 30 miles. Several smaller and -- detached areas occur outside the main belt.

The principal rock types are quartzites, quartz schists, mica schists, and numerous intermediate varieties between -- the two latter types. Conglomerates (sometimes schistose), graphite schists, argillaceous schists, and magnesian limestones also occur.

The quartzites, quartz schists and mica schists are present in almost every exposure of the Pre-Cambrian formations. The conglomerates are present at Port Davey, Calder Pass, and Goat Island (from which locality splendid examples of stretched pebbles are obtained).

The limestones are restricted to Albina (Geological -- Survey Bulletin No. 18) and the Arthur River.

It is evident that the greater number, if not all, of the above types have been derived from sedimentary rocks by regional metamorphism.

In addition to the above, smaller areas of altered -- basic igneous rocks also occur. The largest area of these types is on the Rocky River, while other occurrences are at Collingwood River, Hamilton on Forth, Quamby Brook, etc. The prevailing type is an amphibolite, the principal varieties being zoisite and garnet-zoisite-amphibolites. The original rock were of basic types such as gabbros or basalts.

The schist belts have a general meridional trend. The strikes of the competent beds are in conformity with this trend, but the strikes of the incompetent beds are very -- variable and do not always conform to the meridional -- direction. The dips are at high angles and are generally to the west. There has been little or no evidence of -- folding obtained, but the strata must have been highly -- tilted or folded. If the latter is the correct interpretation, then the structure must be truncated isoclinal folding. The structure has not however been worked out in -- detail. It is impossible on account of this to give even an approximation of the thickness of the series, but it must amount to many thousands of feet.

The age of the above series has not been definitely -- determined, but on the basis of their lithological characters and their structural relations with other series they are -- regarded as Pre-Cambrian or Proterozoic. Their schistose state mature is the most highly developed in the State and they are therefore regarded as the oldest rocks. The field evidence proves that these schists are overlain unconformably by Upper and Lower Palaeozoic rocks, the lowest series of which are regarded as being of Cambro-Ordovician age (see below). This subject has been discussed more fully in the following papers:-

Twebetrees, W.H., Probable Pre-Cambrian strata in Tasmania, Proc. A.A.A.S. 1907

Ward, L.K., The Geology of Tasmania. The Pre-Cambrian Proc. Royal Society Tasmania, 1909

In the last-named paper, Ward recognises two series in the Pre-Cambrian system. The evidence for this occurs on the Surveyor Range where an upper series of quartzites -- unconformable overlie quartz and mica schists. Such a -- relationship has not yet been found in any other part of the State, though it appears in some localities as though the upper portion of the Pre-Cambrian consists of quartzites and the lower of mica schists, forming, however, an apparently conformable series.

THE CAMBRIAN AND ORDOVICIAN FORMATIONS -

With a few exceptions it is impossible with the present state of knowledge in Tasmania to assign any definite age to the Lower Palaeozoic rocks which occur between the Pre-Cambrian schists and the West Coast Range Conglomerate series which is, with a reasonable degree of accuracy, regarded as forming the base of the Silurian system. For this reason, the rocks of the above two systems are generally referred to as belonging to the dual system - the Cambro-Ordovician.

CAMBRIAN -

A few beds have been definitely referred to the Cambrian system on palaeontological evidence. These include;-

- (a) The *Dikellocephalus* sandstones of Caroline Creek. The fossils described from these beds are, -- *Dikellocephalus tasmanicus*, *Asaphus* (sp.), *Ophilita* (sp.), and *Conacephalites* (now *Psychoparia*) *tasmanicus*. (Etheridge Royal Society Tasmania 1882, p.150).
- (b) The *Dikellocephalus* slates of the Florentine Valley. The slates have yielded the following fossils (R. Etheridge Jun. Rec. Aust. Mus. Vol. 1, V. No. 2, 1904, p. 98, Pt.X). *Dikellocephalus florentinensis* Niobe, *Bellerophon*, *Tentaculites*, *Orthis lenticularis*. In correspondence, F. Chapman (17/9/25) states that the *Orthis* is probably a *Billingsella* and evidently a new species.

During 1927, Dr. Whitehouse examined the trilobite remains from the above localities and a brief -- reference in the abstract of Proc. of Royal Society of Queensland states that *Tsinina* was identified. In a letter he also stated - "I have been examining the forms from the Florentine Valley and Caroline Creek lately. It may interest you to know that each of the fossiliferous horizons represents a stage corresponding to the Upper Tremadoc of Europe, and the middle portion of the Lower Ozarkian of North America."

- (c) ? *Hurdia davidi* has been described by Chapman (Royal Soc. Tas. 1925 P. 79) from the slates of Hatfield Plains on the Emu Bay railway. It is referred, with reservation, to the genus *Murdia* in the Middle -- Cambrian of British Columbia.
- (d) *Tasmanadia twelvetrassi* was described by F. Chapman (Roy. Soc. Tas. 1928) from the black slates of the Arthur River. The nearest example is described by C.D. Walcott from the middle Cambrian of Burgess -- Country, New Brunswick under genus *Canada*.

ORDOVICIAN -

It is somewhat doubtful as to whether any suites of fossils definitely referable to the Ordovician Period have been obtained. It is therefore impossible to state on --

palaeontological evidence whether Ordovician rocks occur in the State. As, however, the thickness of Cambro-Ordovician rocks between the Pre-Cambrian schists and the West Coast Range Conglomerate is considerable, it is quite possible that a large thickness of Ordovician rocks exist.

Up till the present, only a few very indefinite graptolites have been found, and these have not been sufficient to determine the age of the containing rocks whether Ordovician or otherwise.

From the limestone at Railton, the following fossils have been described from time to time - Orthes or Strophomena, Strophomena, Actinoceras, Baltaceras sp., Trachoceras sp., and Actinoceras c.f. Aatei. Mr. F. Chapman considers the last three fossils to be of Ordovician age and compares the rocks containing the last two with the Larapintine series of Central Australia, which is of Ordovician age.

It should be mentioned here that many of the types of fossils in the Silurian system have been stated by palaeontologists to have an Ordovician facies. Considering the suites as a whole they have, however, been referred to the Silurian Period. The admixture of apparent Ordovician forms may mean that the Silurian rocks include passage beds from the Ordovician, or even some Upper Ordovician beds.

CAMBRO-ORDOVICIAN -

Owing to the fact that little or no systematic geological mapping has been carried out in the areas from which suites of Cambrian fossils have been obtained, and even where such work has been performed, the conditions are unfavourable for the determination of the structure, the rocks between the Pre-Cambrian schists and the West Coast Range Conglomerate series have, with the exceptions already described, to be referred to the above dual system. Included within it are a number of more or less definitely recognisable series, which will be described separately below. In some localities the sequence of these series has been determined but generally it has not been ascertained.

BASAL SERIES -

The base of the Cambrian or Cambro-Ordovician system is practically unknown especially in the western districts. It is somewhat remarkable that very few areas showing the normal relation of the Pre-Cambrian and the base of the Lower -- Palaeozoic rocks have been discovered and examined.

One of the best areas showing the relation is that near Frankford on the western side of the Tamar River. In this locality conglomerates rest against the Pre-Cambrian schists with an unconformable relation. The conglomerates pass up into quartzites and there is a conformable sequence through slate, quartzites, etc. up to the limestone of the Flowery Gully district. This series, many thousands of feet in -- thickness, should underlie the Mathinna series of north-eastern Tasmania.

Another favourable locality is the De Witt Island off the South Coast where the contact can be seen, but has not yet been examined.

DUNDAS SERIES -

This series includes slates (purple at surface and dark grey at depth), cherts, breccias (fine and coarse-grained) --

tuffs of lava flows (part at least being basic). They occur largely in the western districts between Zeehan and Waratah; in the northern districts such as the Leven River; and in the south central district from Adamsfield to the south.

The fine-grained breccias consist largely, if not wholly, of igneous material. The felspathic type is composed of -- angular grains of feldspar in a matrix of similar material. -- Secondary hematite and chlorite are also present probably -- resulting from the alteration of augite. The micaceous type consists of angular fragments of quartz and feldspar and flakes of mica (biotite and muscovite) in a matrix of the same -- minerals together with hematite, chlorite and calcite.

The coarse breccias contain angular pieces of chert or jasper in a complex groundmass of quartz, feldspar, muscovite, chlorite, kaolin and calcite.

The mineral composition of the slates cannot be determined but it appears to be of similar material to the felspathic breccias. The cherts are associated with the slates and represent silicified portions thereof.

The base of this series is not defined. The summit is known in only one locality, viz, the Read-Rosebery district, where it is overlain by the following series (Hills, Loftus, Tas. Geol. Survey Bulletin No. 19, 23).

READ-ROSEBERY SCHISTS -

This series is largely sedimentary in origin, pyroclastic material forming the remainder. It conformably overlies the Dundas series and is itself overlain by the Porphyroid series of felsites &c.

The schists proper vary widely in character and composition. Only a small proportion are truly schistose, the remainder being argillites. The types of schist include -- chlorite, argillaceous, calcereous and quartzite ones.

PORPHYROID SERIES -

This series is for the most part of igneous origin and consists of a complex group of acid and sub-acid eruptive rocks, with smaller amounts of basic types. Associated with these, there occur minor developments of granites, syenites &c. The rocks have been highly metamorphosed.

The felsites of this series in the Read-Rosebery district overlie the Read-Rosebery schists (Hills, Loftus, Tas. Geol. Survey Bulletin Nos. 19 & 23).

The upper part of the porphyroid series has not been determined, but it is probable that it represents the close of the Cambro-Ordovician system. In numerous localities in -- western and north-western Tasmania this series is overlain unconformably by the West Coast Range series of the Silurian system.

It will be noted that the above three series are conformable in the Read-Rosebery district, and, taken generally, may be considered more or less as one. Loftus Hills (Tas. Geol. Survey Bulletin No. 16) compared the Porphyroid series with the Heathcotic series of Victoria. The present writer (Tas. Geol. Survey Bulletin No. 33) also suggested the -- correlation of the Dundas and the Porphyroid series with the Heathcotic series. If the correlation be a true one, the Dundas and Porphyroid series will belong to the Upper Cambrian system.

BALFOUR SLATE AND SANDSTONES -

This series has been described only from the district of which it bears the name. (Ward L.K., Tas. Geol. Survey Bulletin No. 10). As the name implies the series consists chiefly of interbedded slates and sandstones. The slates comprise beds of different colours such as dark grey to white and occasionally green, and being thinly bedded present a banded appearance.

The sandstones are generally of a white colour and have a range in grain size from almost shaly beds to grits. Cross bedding, ripple marks and probable worm-trails are common. Flat pebbles of slate and sandstones are scattered throughout the rocks, especially the sandstones.

Conglomerates occur to a limited extent. Severe earth movements have produced a slaty cleavage in the rocks and also some contortion.

No fossils have been found in these rocks and they have been referred by Ward to the Cambro-Ordovician system on general geological grounds.

MATHINNA SLATES AND SANDSTONES -

This series includes the whole of the slates and sandstones of north-eastern Tasmania. The slates are generally thinly-bedded, dark coloured types with the cleavage planes generally coinciding with the bedding planes. The sandstones are dark coloured, thickly-bedded types more correctly described as quartzites than sandstones. Basic or ultra-basic dykes intrude the series which also contains decomposed basic lavas and tuffs (Reid, A.M., Tas. Geol. Survey Bulletin No. 37).

The series bears a striking lithological and structural resemblance to the Ordovician system of Victoria, but neither graptolites or other fossils have yet been found in them. The field evidence proves the series to belong to the lower Palaeozoic era and probably the Cambro-Ordovician period. The series probably overlies the basal series of the Frankford district (described above) and so occupies the middle to upper portions of the Cambro-Ordovician system. Though there is no close lithological resemblance, this series is on general grounds correlated with the Dundas and the Mt. Balfour series.

BISCHOFF SLATES AND SANDSTONES -

This series is exposed in the vicinity of Waratah and Magnet.

It consists of interbedded slates and sandstones which have been highly folded into anticlines and synclines. They occupy a faulted block which has apparently been let down into the Dundas series of the district and are therefore younger than the latter. They appear to be older than the Silurian rocks of the district and therefore probably belong to the upper part of the Cambro-Ordovician.

CONCLUSIONS.

An attempt is made in the following table to correlate the Cambro-Ordovician in the different parts of the State. This is in accordance with the above descriptions with a few exceptions which are brought about by the inclusion of the limestones in the table. As shown above there is some evidence for the Ordovician age of the Railton limestone and the Flowery Gully limestone would be of the same age. It is almost certain that the Flowery Gully limestone underlies the Mathinna series, so it is difficult to conclude otherwise than that the limestone is anything but Ordovician or lower in age.

The only calcareous beds in western Tasmania on a similar horizon to the limestone of Railton and Flowery Gully are those in the Read-Rosebery schists. If these be correlated it has the effect of elevating the Mathinna series and probably also the Balfour series above the general horizon of the Dundas. While this differs from the attempted correlations with the Dundas, it is not a serious objection as the correlations were on general grounds and somewhat slender evidence.

The possible correlation with Victorian systems is suggestive. The Dolodrock limestone (Upper Cambrian) lends some support to the inclusion of the Railton and Flowery Gully limestones in the Cambro-Ordovician.

signed
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12th May, 1928

	South Central	Western	North Western	Northern	North Eastern	Possible correlation with Victorian Systems
SILURIAN	West Coast Range Conglomerate Series Etc.					
	Period of Diastrophism					
ORDOVICIAN			Balfour Series		Mathinna Series	Ordovician Slates and Sandstones
CAMBRO-ORDOVICIAN		Porphyroid Series		Porphyroid Series		Heathcote Series
		Read-Rosebery Schists	Smithton Limestone	Railton limestone?	Flowery Gully limestone (conformable with basal series)	Dolodrock limestone
	Dundas Series	Dundas Series	Dundas Series	Dundas Series		
	Dikelocephalus slates (Florentine Valley)	Slates with Hurdia davidii	Slates with Tasmanadia twelvetreesi	Dikelocephalus sandstones (Caroline Ck.)		
CAMBRIAN	?Basal series of slates and quartzites				Basal Series (Frankford district)	
	Period of Diastrophism					
PRE-CAMBRIAN	Schists and quartzites					